4.15 Surface Roughening

Su

Definition

Providing a rough soil surface with horizontal depressions created by operating a tillage or other suitable implement on the contour, or by leaving slopes in a roughened condition by not fine-grading them.

Purpose

Surface roughening is used for the following: (1) to aid in establishment of vegetative cover with seed, (2) to reduce runoff velocity and increase infiltration, and (3) to reduce erosion and provide for sediment trapping.

Conditions

All slopes steeper than 3:1 require surface roughening, either stair-step grading, grooving, furrowing, or tracking if they are to be stabilized with vegetation.

Areas with grades less steep than 3:1 should have the soil surface lightly roughened and loosened to a depth of 2 to 4 inches prior to seeding. Areas that have been graded and will not be stabilized immediately may be roughened to reduce runoff velocity until seeding is performed. Slopes with a stable rock face do not require roughening or stabilization.

Design Criteria

Graded areas with smooth, hard surfaces give a false impression of “finished grading” and a job well done. It is difficult to establish vegetation on such surfaces due to reduced water infiltration and the potential for erosion. Rough slope surfaces with uneven soil and rocks left in place may initially appear unattractive or unfinished, but will encourage water infiltration, speed the establishment of vegetation, and decrease runoff velocity.

Rough, loose soil surfaces provide lime, fertilizer, and natural coverage for seed. Niches in the surface provide microclimates that generally provide a cooler and more favorable moisture level than hard flat surfaces, which aids seed germination.

There are different methods of achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, and tracking. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

1. Disturbed areas that will not require mowing may be stair-step graded, grooved, or left rough after filling.

2. Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each “step’ catches material that sloughs from above and provides a level site where vegetation can become established.

3. Areas that will be mowed (there areas should have slopes less steep than 3:1) may have small furrows left by disking, harrowing, raking, or seed planting machinery operated on the contour.

4. It is important to avoid excessive compacting of the soil surface when scarifying. Tracking with bulldozer treads is preferable to not roughening at all but is not as effective as other forms of roughening, as the soil surface is severely compacted and runoff is increased.

Construction Specifications

Cut slopes with a gradient steeper than 3:1 shall be stair-step graded or grooved (see Figures 4.15.1 and 4.15.2).

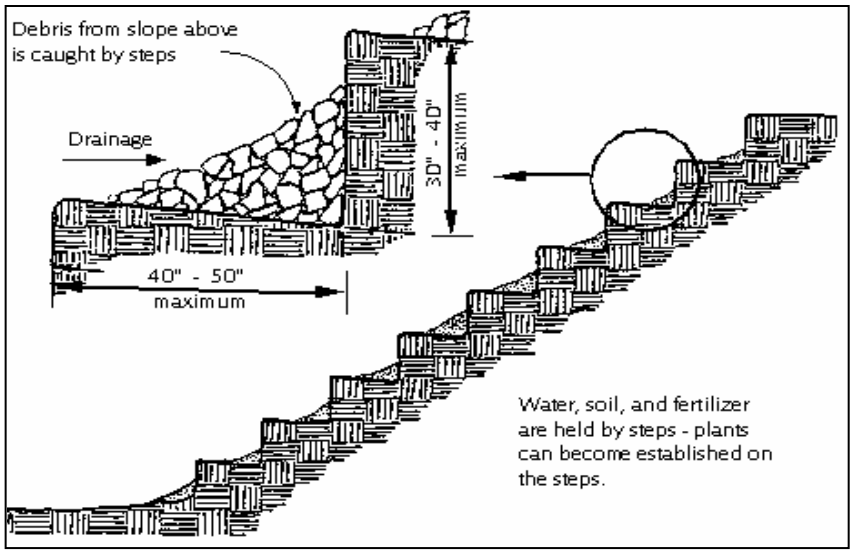

Figure 4.15.1 Stair-Stepping Cut Slopes

Stair-Step Grading

Stair step grading may be carried out on any material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.

Figure 4.15.2 Typical Stair-Step Grading

The ratio of the vertical cut distance to the horizontal distance shall be less than 1:1 and the horizontal portion of the “step” shall slope toward the vertical wall.

Grooving

Grooving consists of using machinery to create a series of ridges and depressions, which run perpendicular to the slope (on the contour).

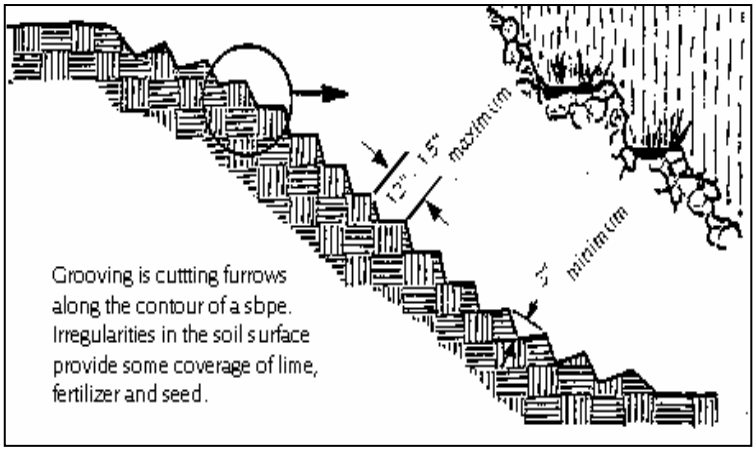

Figure 4.15.3 Grooving Slopes

Grooves may be made with any appropriate implement that can be safely operated on the slope and will not cause undue compaction. Suggested equipment includes discs, tillers, spring harrows, and the teeth on a front-end loader bucket. Grooves shall not be less than 3 inches deep nor further than 15 inches apart.

Fill Slope Applications for Areas That Will not be Mowed

Fill slopes with a gradient steeper than 3:1 shall be grooved or allowed to remain rough as they are constructed. Either of the following methods may be used.

1. Perform grooving as mentioned previously.

2. As lifts of the fill are constructed, soil and rock material may be allowed to fall naturally onto the slope surface.

Colluvial measures (soil deposits at the base of slopes or from old stream beds) shall not be used in fill as they flow when saturated.

Cuts, Fills, and Graded Areas That Will be Mowed

Mowed slopes should not be steeper than 3:1. Excessive roughness is undesirable where mowing is planned.

These areas may be roughened with shallow grooves by tilling, disking, harrowing, raking, or use of a multipacker-seeder. The final pass of any such tillage implement shall be on the contour (perpendicular to the slope).

Grooves formed by such equipment shall be not less than 1 inch deep and not further than 12 inches apart.

Fill slopes that are left rough as constructed may be smoothed with a dragline or pickchain to facilitate mowing.

Roughening With Tracked Machinery

Roughening with tracked machinery on clay soils is not recommended unless no alternatives are available. Undue compaction of surface soil results from this practice. Sandy soils do not compact severely and may be tracked. In no case is tracking as effective as the other roughening methods described.

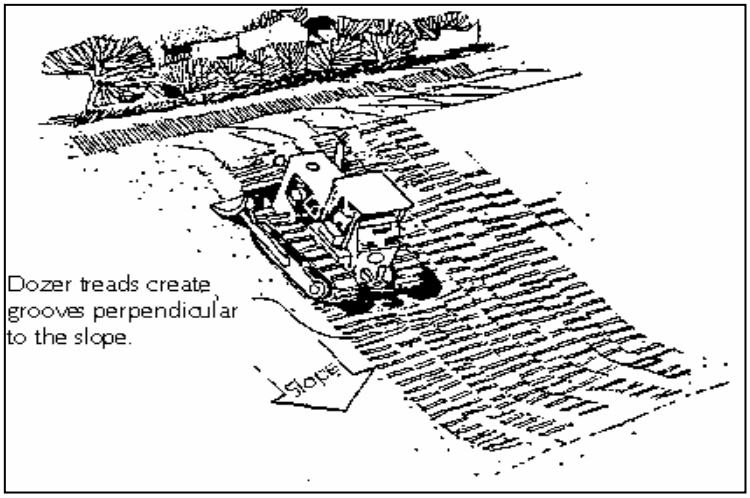

Figure 4.15.4 Roughening with tracked machinery.

When selected, tracking shall be performed by operating tracked machinery up and down the slope to leave horizontal depressions in the soil. As few passes of the machinery as possible should be made to minimize compaction.

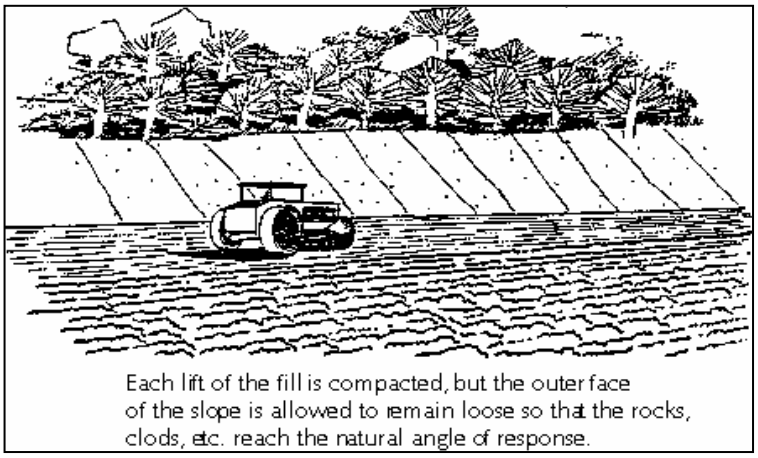

Figure 4.15.5 Fill slope treatment.

Seeding

Roughened areas shall be seeded and mulched as soon as possible to obtain optimum germination and seed growth.